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Mercedes-Benz

Mercedes-Benz USA, LLC
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April 4, 2003

NHTSA-03-14345-3

The Honorable Jeffrey W. Runge, M.D.
Administrator
National Highway Traffic Safety Administration
400 Seventh Street, S.W.
Washington, D.C. 20590

Petition for Rulemaking
49 C.F.R. 571.108
Lamps, Reflective Devices and Associated Equipment

Dear Dr. Runge:

This petition for rulemaking is submitted by Mercedes-Benz, U.S.A. LLC (MBUSA) on behalf of its parent corporation DaimlerChrysler AG (DCAG). DCAG seeks a change in Federal Motor Vehicle Safety Standard (FMVSS) regulations to permit vehicle manufacturers to provide heightened safety to customers by equipping motor vehicles with brake lights that automatically flash upon rapid deceleration of the vehicle. DCAG petitions the National Highway Traffic Safety Administration (NHTSA) to undertake a rulemaking to amend FMVSS 108 (S.5.5.10) which currently prohibits installation of flashing lights on motor vehicles except in limited specified circumstances. A recent research study funded by DCAG has documented that appropriately designed flashing brake lights significantly reduce drivers' reactions times and thus can reduce the incidence and severity of rear-end collisions. Thus, pursuant to 49 C.F.R. Part 552, DCAG requests that NHTSA undertake a rulemaking to propose amending FMVSS 108 to permit manufacturers, on an optional basis, to install flashing emergency brake lights that meet appropriate safety-related requirements.

Background

FMVSS 108 requires that all lamps shall be wired to be steady burning other than turn signal lamps, hazard warning signal lamps, school bus warning lamps, headlamps and side marker lamps wired to flash for signaling purposes. In interpretation letters and policy statements, NHTSA has repeatedly identified the rationale for 108's restrictions on flashing signals as safety-based. Specifically, the Agency has indicated that standardization of lighting functions is paramount to the necessary and instant recognition of their meaning by other drivers, and that permitting manufacturers to include a flashing function in lamps other than those specified could diminish the importance of the safety meaning of required lamps. See, e.g., Federal Motor Vehicle Safety Standards: Lamps, Reflective Devices and Associated Equipment, Policy Statement, 63 Fed. Reg. 59482 (Nov. 4, 1998); March 1996 legal interpretation to Gillig Corporation; August 1999 legal interpretation to law firm of Helfgott and Karas, P.C.

For similar reasons, international laws such as ECE-R 48 and the Vienna Convention also currently prohibit flashing brake lights. In recent years, however, the international community has undertaken to study various proposals for allowing flashing lights as an emergency braking signal in response to arguments that the current approach is preventing implementation of a potentially important enhancement of traffic safety that could significantly reduce the number and severity of rear end collisions. Specifically, the matter has been under consideration by the Working Party on Lighting and Light-Signaling (GRE) of the Economic Commission for Europe (ECE).

Rear end collisions are a significant traffic safety concern throughout the world, and particularly in nations with dense traffic patterns. In the United States, 5.2% of fatal crashes and 30% of injury crashes are the result of rear end collisions, with economic costs estimated at $18.3 billion dollars a year. In 20% of all injury crashes caused by a rear end collision, the lead (target) vehicle was performing a braking maneuver when the accident happened (NASS-GES, NASS-CDS, Traffic Safety Facts 2001). Data from other countries suggest rear end collisions account for as much as one-fifth (Germany 2001) to one-third (Japan 1999) of all accidents.

While NHTSA is certainly correct that drivers need to be able to interpret lighting signals instantaneously and thus there is a certain value to maintaining consistency of the standard, it is also true that one important cause for rear end collisions is that the driver in the following vehicle does not detect that the vehicle in front has performed an emergency braking action. This is a result of the lack of any difference in the conventional signal for general braking and for emergency braking action - i.e., conventional brake lights are the only signal provided to followers in both situations. A signal that is more likely to attract immediate attention from following drivers than conventional brake lights and is intuitively interpreted by following drivers as representing a more urgent braking situation would seem a promising approach to achieve greater safety. The benefit of an enhanced signalization scheme accrues not only to the immediately following driver, but also to drivers of vehicles in a queue situation, providing additional safety potential in today's dense traffic situations.

In the past, however, there has not been persuasive scientific data regarding whether flashing brake lights have a safety benefit. NHTSA's 1998 Policy Statement on FMVSS 108 details the agency's concerns about weaknesses in data previously presented to the agency on this topic and concludes by articulating a procedure the agency will follow for evaluating requests to change FMVSS 108: when a petition is presented without supporting data, the agency will treat it as a suggestion for research and forward it to a public docket that will collect information describing all proposed new signal lighting ideas and systems. If a petition includes data, however, the agency will evaluate the data to determine if they show persuasive evidence of a positive safety impact. If so, the agency will conduct a rulemaking to permit or require the new signal lighting idea. <u>See</u> 63 Fed. Reg. at 59490.

In this petition, DCAG describes a fast flashing emergency braking signal proposal developed in Germany that offers a promising approach to greater traffic safety, and also describes the results of recent research that found that such an emergency braking signal significantly reduces the reaction time of following drivers to the signal.

Emergency Braking Signal Promises Greater Traffic Safety

DCAG supports and suggests NHTSA consider as a basis for an NPRM, the emergency braking signal proposal that was developed according to recommendations by the German Federal Highway Research Institute BASt and presented by Germany at the ECE-GRE meeting in September 2002. This proposal enhances the emergency braking signal by flashing all three brake lights at a frequency of 5 +/-2 Hz in the case of strong deceleration. Its primary features are as follows:

- For **normal braking** the conventional brake light signal is activated.
- For **intensified braking** (i.e. deceleration of 5 -7 m/sec^2) the manufacturer has the option to increase the intensity and / or light-emitting surface of the side mounted brake lamps. Intensity may only be varied within the legal limits. Surface may also be increased by activation of two additional lamps. This feature is an optional one only.
- For **emergency braking** all three brake lights flash at a frequency of 5 +/-2 Hz. The emergency brake signal should occur only rarely, when it is truly an emergency braking situation. The following conditions for activation of this function are suggested:
    - The deceleration is > 7 m/s^2 and/or
    - A brake assist function is active and/or
    - An ABS system meshes in more than one wheel.

  Also the signal should only occur at a velocity > 10 km/h (6.2 mph).
- After such an emergency braking (beginning at velocity < 10 km/h), the proposal provides for automatic activation of the hazard warning lights of the stopped vehicle until either it starts to move again or the lights are manually switched off. This would enhance recognition of stopped vehicles such as at the end of a traffic jam. According to NASS-GES/NASS-CDS, 80% of injury crashes caused by rear end collisions involve stopped or slow moving lead (target) vehicles.

The proposal for emergency braking is based on the following considerations:

- The frequency range was chosen for these reasons:
    - A high frequency allows for fast recognition that the signal is actually flashing. Lower frequencies (as for example the 1.5 Hz typically used for hazard warning lights) require a time span for recognition of the flashing that is already in the

range of the reaction time. Hence, a gain in reaction time is not possible with a slower flashing frequency.

- Conventional brake lights equipped with filament bulbs can emit a signal that is clearly observed as flashing up to a frequency of about 5 Hz. For higher frequencies, the flashing starts to become imperceptible.
- Brake lights equipped with LEDs can be used at higher frequencies showing a very distinct flashing signal. With these lamps, flashing at 7 Hz has been found to be even more effective than at 4 or 5 Hz.

- The activation criteria reflect that in order to avoid "optical pollution" and also to ensure the early warning effect of the signal, it should occur only rarely and when it is really needed. Hence, the threshold for activation has been set rather high:
  - The suggested deceleration > $7 m/s^2$ represents a severe braking situation. To understand how often such braking occurs in the US, DCAG evaluated the results of a study in which 15 Mercedes-Benz vehicles in the USA were equipped with a recorder of driver behavior and vehicle dynamics. A total of 96 subjects were each given a vehicle for one week and drove a total distance of 55,000 miles (33,800 miles around Montvale, NJ, and 21,300 miles around Los Angeles, CA)]. The number of braking maneuvers at decelerations of more than $7 m/s^2$ was 9 for CA and 15 for NJ. This translates to one emergency braking maneuver for every 2291 miles driven.
  - In fact, only 24 of the 103,865 braking maneuvers that were analyzed showed a deceleration of more than $7 m/s^2$. This study suggests that only approximately 23 out of 100,000 braking maneuvers are emergency braking maneuvers, which would activate flashing brake lights. According to "Traffic Safety Facts 2001," 221,230,000 registered motor vehicles travel a total of 2,781,000.000 miles in the U.S. So the average yearly mileage is 12,750 miles per vehicle. On this basis, it can be assumed that the signal would occur on a vehicle about 5.5 times per year.
  - If a vehicle is equipped with a brake assist function, then its activation is the best possible trigger for the signal, because the brake assist automatically guarantees that the vehicle decelerates with the maximum possible performance.
  - Deceleration must not be the only criterion for activation of the signal. For example, under slippery conditions a high deceleration (> $7 m/s^2$) may not be achievable even when a driver seeks it. Hence it is desirable to also detect such critical situations automatically. When a vehicle is equipped with an antilock braking system, the system will mesh in whenever the achievable deceleration is smaller than the demanded one. DCAG believes the emergency braking signal should be triggered whenever the ABS system meshes in on more than one wheel in order not to have activations in rather frequent, noncritical situations such as when one wheel briefly slips through a puddle. Manufacturers need freedom of

choice among these criteria because their application requires different prerequisites in the vehicle.

- The inclusion of brake assist and ABS in the triggering criteria will certainly raise the frequency of occurrence of the flashing brake lights signal. However, we believe that the increase will be slight, and that the increased safety benefits that accrue from these relatively few additional cases of activation due to these criteria are worth achieving.

- A minimum velocity for the signal is required because sometimes rather high decelerations occur in the final phase of a braking maneuver (just before standstill) and these should not trigger the signal.

The signalization proposal described above meets several important goals of any emergency braking indicator:

- it provides for faster recognition of emergency braking by following drivers, and thus shorter reaction times;
- it encourages the maximum deceleration of following vehicles; and
- it provides an intuitive display that doesn't require learning to communicate its message.

Recent Research Finds Fast Flashing Brake Lights Reduce Driver Reaction Time

DCAG has recently funded field and driving simulator studies to promote evaluation of the signalization proposal described above and its impact on rear end collisions. Attached to this petition, as Exhibit A, is a report detailing the statistically significant results of the field research. As demonstrated in Exhibit A, fast flashing brake lights, such as the proposal detailed above, reduce driver reaction time by 0.2 seconds on average. The research was conducted by Dr. Joerg Breuer and Thomas Unselt, whose professional qualifications are attached to this petition as Exhibit B. The results of their work were presented as a contribution of the German delegation at the September 2002 meeting of ECE-GRE.

The goals of the research were to compare reaction times in emergency braking situations among conventional brake lights, conventional brake lights combined with hazard warning lights, flashing brake lights with a flashing frequency of 4 Hz, and flashing brake lights with a flashing frequency of 7 Hz. Experiments were conducted on a test track in August of 2002. The research, quantifies reaction times of ordinary drivers in real emergency braking situations as a function of different signalization alternatives. It statistically documents a gain in reaction time of up to 0.2 seconds when flashing brake lights signal emergency braking as compared to other braking signals.

A small improvement in reaction time can have significant impacts on traffic safety. A reduction of the driver's reaction time by 0.2 seconds is likely to result in a meaningful reduction in the number and/or severity of rear end collisions. This finding is illustrated by Figure 2 in Exhibit A, which shows the velocity over traveled distance of 2 vehicles where the start of the constant deceleration of 8 m/s^2 differs by only 0.2 seconds. It shows that for the vehicle braked earlier the stopping distance is shortened by 4.4m (14.6 ft), while the other vehicle at that location still has a velocity of about 30 km/h (18.6 mph), which would result in a potentially serious impact that might even trigger air bags. In addition, during the first 0.2 seconds, the braked vehicle reduces its kinetic energy by 14.4%; a gain that remains during the entire braking maneuver and that significantly reduces the consequences of an impact.

Summary of the Study

The field research conducted by Breuer and Unselt consisted of 39 subjects aged 18-63 years (the average age was 36); 39% of the subjects were female, and 61% were male. The subjects were asked to perform a car-following task with different driving maneuvers. This part of the experiment, while time-consuming to conduct, was designed so that the subjects would focus on certain driving tasks to approximate normal driving conditions rather than anticipate emergency situations all the time. The leading vehicle performed emergency braking operations, thus actuating one of the lighting signals under consideration. The reaction times of the following drivers were measured. To eliminate the differing reaction capabilities of the subjects, their individual base line reaction time was measured directly after the driving tests, when they remained in the driver seat of their vehicle, which was parked about 40 meters (131 ft) behind the now stationary lead vehicle. The subjects were asked to hit the brake pedal as soon as they saw the conventional brake lights of the lead vehicle come on. They each did this 5 times, and their individual baseline reaction time was calculated from the average of the results. In addition, each of the subjects was asked to rate their acceptance of the four types of lighting signals.

Results

As previously noted, the study showed that on average the flashing brake lights resulted in the following driver reacting to the signal 0.2 seconds faster. The effect of such a reduction has been discussed above. It is considered significant in terms of crash avoidance or crash severity reduction. Moreover, an even higher reduction can be expected in real world driving conditions. In general, test subjects tend to react faster than drivers because subjects who participate in experiments in a driving simulator or on a test track are generally more focused on the driving task than drivers on the road who are subject to many sources of distraction.

Positive effects from the fast flashing signal were also observed in the study under conditions involving weather effects and distraction. In rainy conditions, there were longer reaction times to every lighting signal. The biggest increase, however, was found for hazard warning lights (mean: 0.12 seconds), while the lowest increase was found for flashing brake lights (mean < 0.06 seconds). Distraction effects were observed in the laboratory testing, where drivers were asked to perform a secondary task while simulating following a preceding car. All subjects displayed longer reaction times to all signal types when performing secondary tasks (averaging 0.1 seconds), but there were significantly shorter delayed reactions for flashing brake lights (at the 7 Hz rate).

When surveyed regarding their acceptance of the various brake light signals, test subjects expressed a preference for flashing brake lights. When asked to rank the four signals using a scale of 1 (the best) to 4 (the worst), most of them preferred the flashing brake lights (at the 7 Hz rate, 62 percent). The average ranks are: flashing 7 Hz 1.5, hazard warning lights 2.2, conventional brake lights 3.1, flashing 4 Hz 3.2. The differences between the conventional brake lights and the flashing brake lights at 4 Hz are not considered to be significant. These results show that drivers would accept flashing brake lights. It should be noted, however, that drivers' acceptance of flashing brake lights should not be a key consideration in deciding whether manufacturers should be permitted to install them, especially given the relative infrequency with which drivers would see such lights. The key consideration must be the efficacy of flashing brake lights in achieving safety benefits.

In short, the study showed that flashing red brake lights provide a non-ambiguous, intuitively interpreted signal of an emergency situation and reduce reaction times by up to 0.2 seconds compared with conventional brake lights. The research also showed that hazard warning lights do not significantly reduce reaction times in emergency braking situations. This however can easily be explained considering the frequency of the signal. Hazard warning lights typically operate at 1.5 Hz, which results in a cycle time of 0.67 seconds. In order to recognize a flashing signal as such, a driver has to go through at least one cycle. Hence, it is obvious that with a cycle time in the area of human reaction times one cannot obtain a shortening effect. Attached, as Exhibit C, is a CD containing video of the testing described above.

<u>Safety and Other Benefits of the Proposed Emergency Braking Signal</u>

When emergency brake light displays were discussed at the 48th session of the GRE-ECE in April of 2002, GRE participants were requested to evaluate and rethink various European proposals with regard to the following list of concerns:

(1) the cost-efficiency of such a system; (2) the nature of the light-signaling device ("red-colored" stop-lamps or "amber colored" hazard warning signal); (3) the nature of the illuminating surface (single lamp or additional lamp); (4) mandatory or optional installation of the emergency braking signalization; (5) the value of deceleration at which the system has to operate; (6) the flashing rates of the light-signaling device; and (7) vehicles already stopped in the traffic as result of emergency or ordinary deceleration. Allowing the optional installation of emergency braking signalization consistent with the proposal described above, and as tested in the study described above, is the most satisfactory option with regard to many of these factors.

<u>Value of Flashing Lights in Proposed Emergency Braking Signal</u>. DCAG is aware that NHTSA and others have some concerns about what is referred to as "optical pollution," that is, whether permitting such flashing signals on motor vehicles will result in such a proliferation of flashing lights that drivers cease to notice and/or respond to the signal as an indicator of an emergency braking situation. However, as indicated in the research described above, such a signal will occur rarely. DCAG's research suggests it will occur not much more often than every other month on a given vehicle. In our opinion, this is rare enough to ensure the appropriate

emergency response to the signal. Most importantly, drivers are accustomed to reading signals such as braking lights that occur frequently. So long as the signal for emergency braking is distinctive and intuitive, it is unlikely to become "optical pollution." Regardless of how many times emergency braking occurs, the emergency signal should be given in order to achieve the safety benefits of the distinctive lighting signal.

Importance of Higher Flashing Rate of Lights for Traffic Safety. DCAG's research has indicated a greater reduction in driver response time when a higher rate is used for the flashing brake lights. Some have questioned, however, whether NHTSA should allow flashing red emergency brake lights that flash at a frequency higher than permitted on school buses. FMVSS 131 requires that the lights on the stop signal arms that are extended when a school bus is stopped to load or unload students shall have a flash rate of 60-120 flashes per minute, which is only 1-2 Hz. However, the frequency that is appropriate for school buses would not be suited to provide the safety benefit in emergency braking. It is inappropriate to compare the (frequently occurring) stationary situation of large, slow-moving school buses to the (rarely occurring) emergency situation of a car.

Another concern that has been raised about flashing lights and traffic safety is the potential for some flashing lights to provoke potential adverse reactions in some people similar to epileptic seizures, even in some persons not susceptible to epilepsy. This phenomenon is referred to as "photic driving." NHTSA in rulemaking proceedings and guidance has indicated that, from available studies, people are most likely to be affected if the flash rate is about 10 flashes per second (600 flashes per minute) and/or when the background is dark. See Federal Motor Vehicle Safety Standards: Air Brake Systems, Notice of Proposed Rulemakings, 55 Fed. Red. 4453, 4455 (Feb. 8, 1990) and Sept. 28, 1993 guidance letter from John Womack to Richard Horian, Woodleaf Corporation. However, it should be noted that the brake light signal of a vehicle in front emits a rather small portion of the overall light intensity that enters a driver's eyes under most circumstances. (Even at night the driver also sees his surroundings as lit by his driving lights.) Further, DCAG is not aware of any reported problems in this situation. Hence, we do not expect a big risk of epileptic seizures occurring. However, the rulemaking process certainly should help to address any concerns that might exist with regard to this issue.

Value of Hazard Warning Signal After Vehicle Stops. The proposal to display the hazard warning signal when an emergency braking vehicle comes to a complete stop is intended to address another very important safety concern, the portion of rear end collisions that occur when the preceding vehicle has come to a complete stop. Bearing in mind that 62% of rear end collisions in the USA involve stopped vehicles (and another 18% involve slowly moving vehicles), activating the hazard warning signal in such circumstances will likely add to the effectiveness in alerting following drivers, and therefore should be included in the proposal.

Cost-Effectiveness of the Proposed Emergency Braking Signal. In the 1998 Policy Statement on FMVSS 108, NHTSA noted that it evaluates any petitions to require motor vehicle equipment according to a cost-effectiveness principles. That is, NHTSA seeks to ensure that the safety benefits for the new equipment are sufficient to justify the costs that will be imposed on the American people. 63 Fed. Reg. at 59492. DCAG is petitioning only for a change in the regulations to permit, not require, the proposed emergency braking signal, and thus NHTSA's evaluation is not subject to the cost-effectiveness consideration. Even if it were, DCAG estimates that, installed on an optional basis, a manufacturer can equip vehicles with the proposed emergency brake lighting signal at a maximum cost of about $6 per car. This is a more than reasonable cost for the safety benefit, even if all consumers were required to pay it. It would nevertheless be beneficial to understand the relative costs and benefits of flashing emergency brake lights. One way to estimate them would be to calculate the number of crashes that could be avoided if the brake lights were in place on all cars. It would be helpful if NHTSA were to calculate such estimates from government data.

Rulemaking Sought

In conclusion, based on the data and analysis presented in this petition, DCAG respectfully requests NHTSA to issue a Notice of Proposed Rulemaking proposing to revise FMVSS 108 to permit flashing red brake lights to be installed on an optional basis as an emergency braking signal on motor vehicles.

Sincerely,

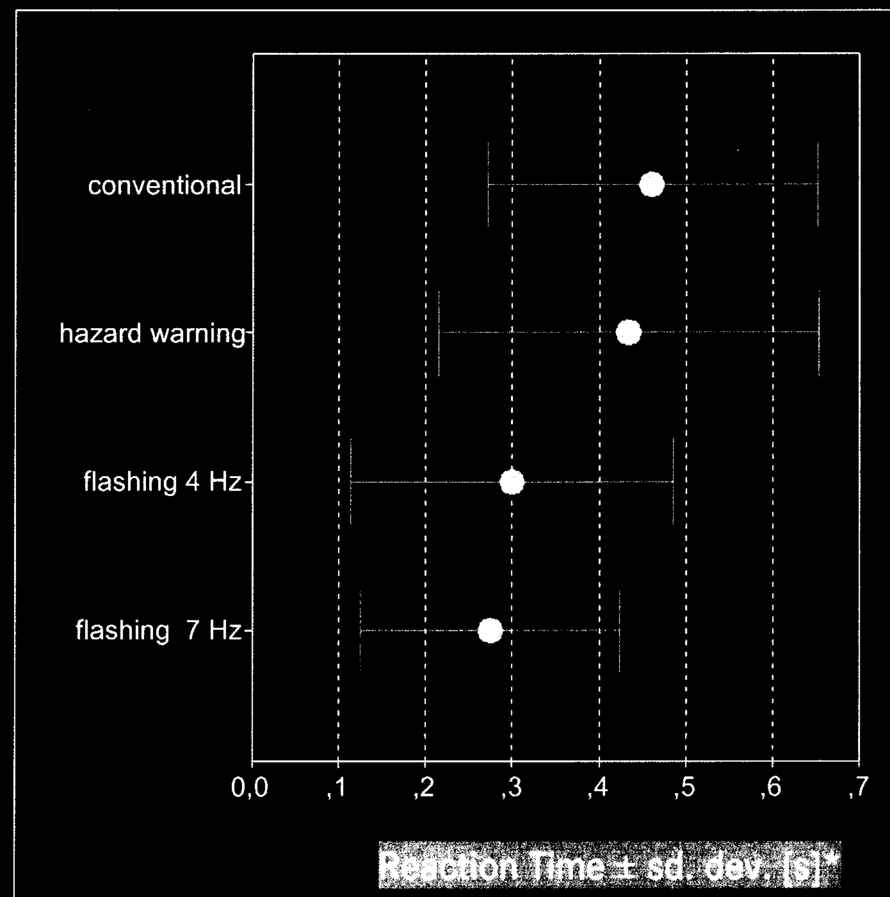
William Kurtz
Mercedes-Benz USA LLC
General Manager,
Engineering Services
One Mercedes Drive
P.O. Box 350
Montvale, NJ 07645-0350

cc: Stephen R. Kratzke,
Associate Administrator for Rulemaking

Exhibit A
Fig. 1: Reaction Times* (first emergency braking)

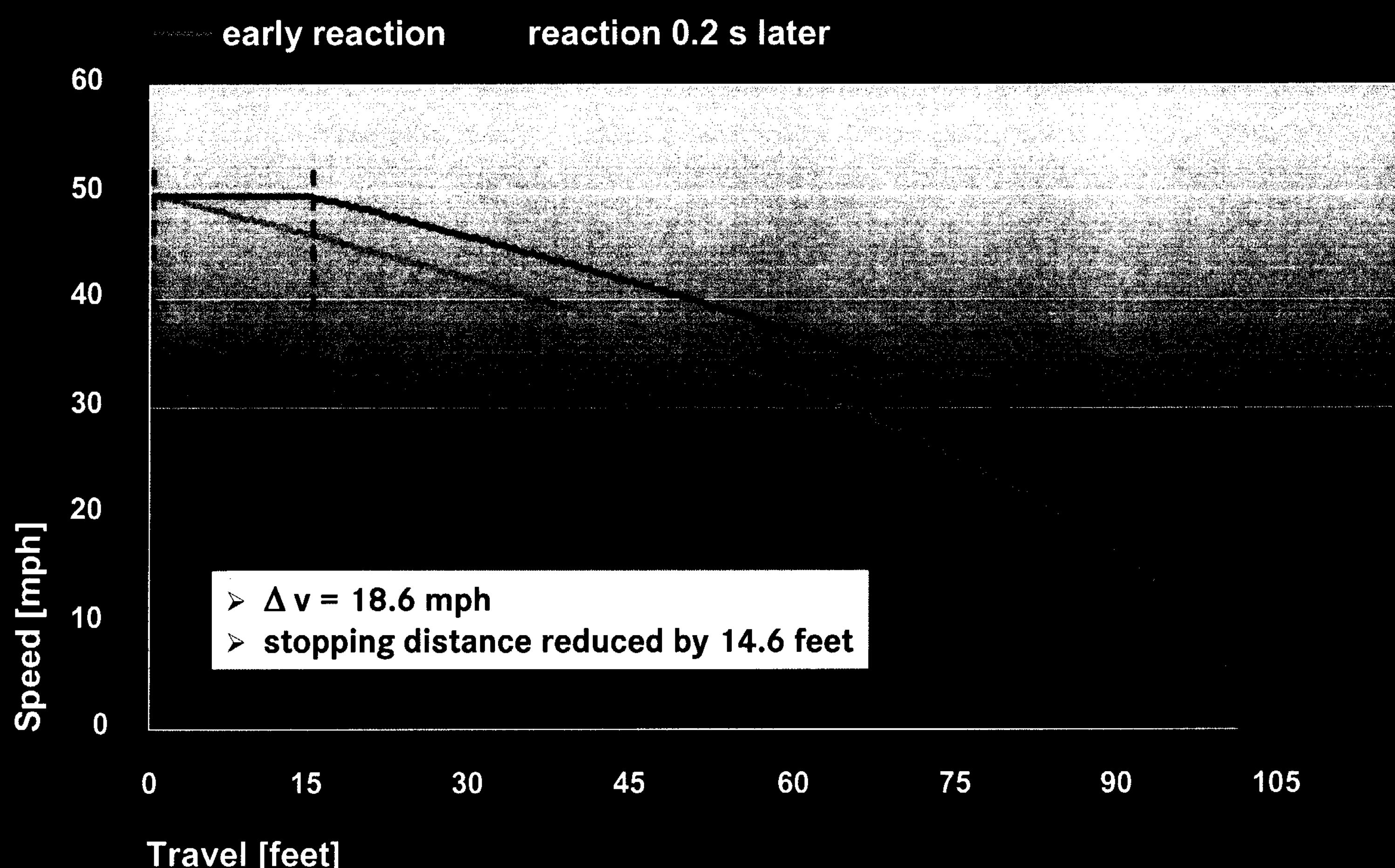
- Flashing brake lights significantly reduce mean reaction times by up to 0.2 s

* standardized by subtraction of baseline value of reaction time to brake lights (stationary vehicles)



DaimlerChrysler

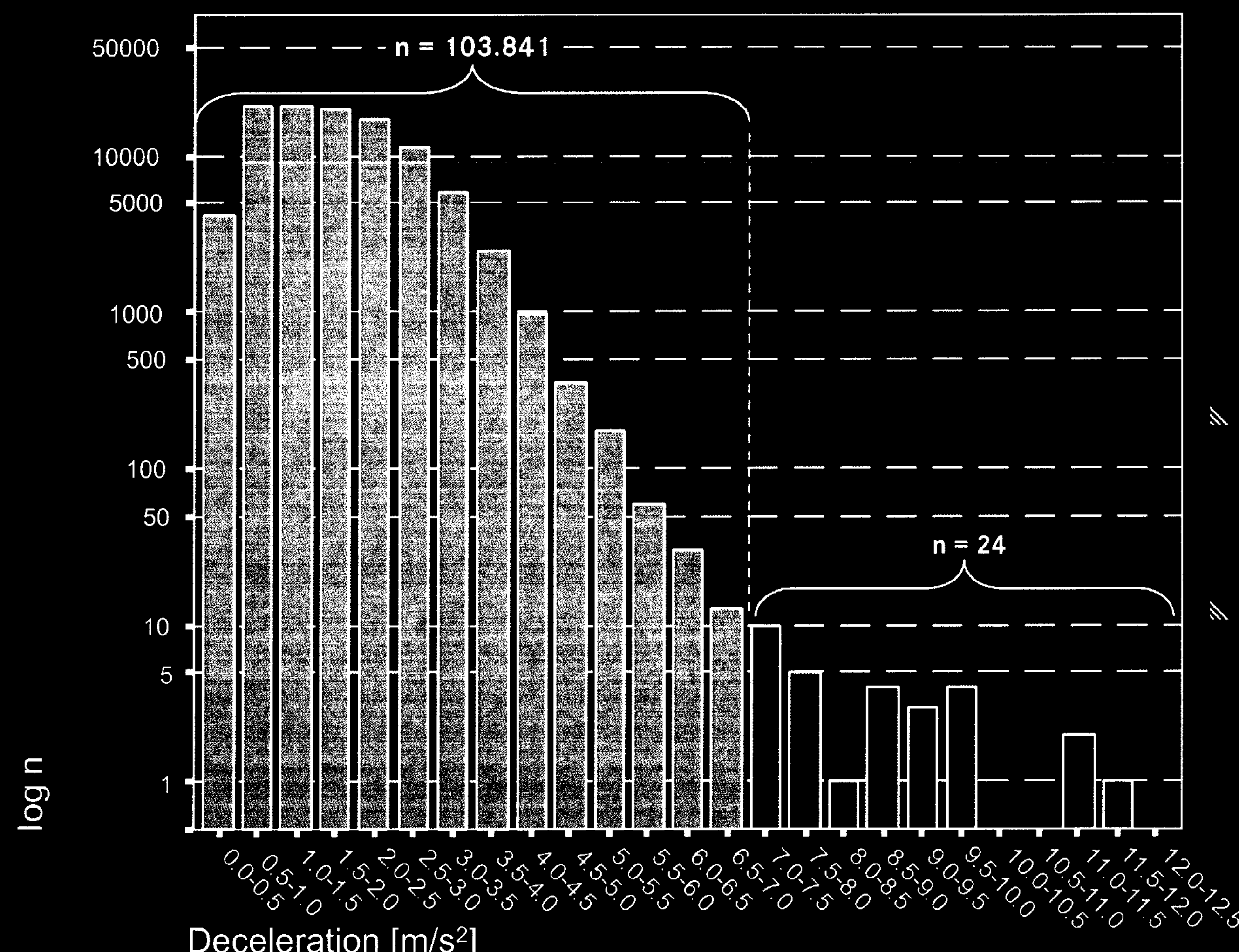
Exhibit A
Fig. 2: Safety Benefit of Earlier Brake Reaction*



* estimation based on deceleration of 8 m/s²

DaimlerChrysler

Exhibit A
Fig. 3: Activation Criteria, Driver Behavior Analysis
(Field Test USA: 96 subjects, 55.000 miles traveled)



- Only 24 of the 103.865 braking maneuvers that were analyzed showed a deceleration of more than 7 m/s^2
- On this basis, it can be assumed that the signal would be seen by a driver about 5.5 times per year

(data basis: yearly mileage 12.570 miles per vehicle, Traffic Safety Facts 2001)

Exhibit B

Professional Qualifications

Dr. Joerg J. Breuer

1992	Degree in mechanical engineering at Technical University of Darmstadt ("Diplom-Ingenieur")
1992-1996	Institute of Ergonomics (University of Darmstadt)
1995-1996	Teaching position (business management) at University of Applied Sciences, Wiesbaden
09/1995	Dissertation "Ergonomische Beurteilung und Gestaltung der Sicherheit des Arbeitssystems Kraftfahrzeugführen" (Ergonomic Evaluation and Enhancement of Active Safety in the Work System Car Driving)
1996-1997	Daimler-Benz AG, Research & Technology: research engineer in the department "Man-Machine Interactions", projects: accident causation analysis, driver behavior in critical situations, advanced design of vehicle dynamics
Since 1998	DaimlerChrysler AG, Mercedes Car Group/Development; current position: Senior Manager Active Safety

Memberships:

SAE, VDI, GfA (German Society of Ergonomists, Executice Committee member), ACEA Task Force Active Safety (Pilot)

English Publications Addressing Active Safety Issues:

HORST, A.R.A. v.d.; HOGEMA, J.H.; BREUER, B.; PRÄCKEL, J.; BIELACZEK, C.; ROHMERT, W.; BREUER, J.; BRUDER, R.; VOS, A.P. de: Driver Behaviour under Normal and Bad Weather Conditions. Brussels: Commission of the European Communities - R&D programme Telematics Systems in the Area of Transport (DRIVE II): Deliverable No. 7 Workpackage A1 1993

ANDREWS, M.; REUTER, U.; BREUER, B.; BIELACZEK, C.; ROHMERT, W.; BREUER, J.; KLEUSKENS, R.: Information, Warning and Support Strategies. Brussels: Commission of the European Communities - R&D programme Telematics Systems in the Area of Transport (DRIVE II V-2045): Deliverable No. 9 Workpackage A4 1994

ROHMERT, W.; BREUER, J.: Measurement and Evaluation of Car Drivers' Adaptation Processes to a Driving Task. In: MCFADDEN, S.; INNES, L.; HILL, M. (Hrsg.): Proceedings of the 12th Congress of the International Ergonomics Association. Mississauga: Human Factors Association of Canada 1994

BREUER, J.; ROHMERT, W., BREUER, B.; BIELACZEK, C.: Human Determinants of Active Safety: Results of Interdisciplinary Driver Behaviour Experiments. Fifteenth International Technical Conference on the Enhanced Safety of Vehicles (ESV) Melbourne, Australia, May 13-17, 1996. Washington, D.C. (USA): Department of Transportation 1996

BREUER, J.; ROHMERT, W.; BREUER, B.; BIELACZEK, C.: Effects of Human Stress, Individual Characteristics, and Strain on the Safety of Driver Performance. XXVI FISITA Congress "Engineering Challenge - Human Friendly Vehicles" 16.-23.6.1996 in Prag (CD ROM 1996)

BIELACZEK, C.; BARZ, M.; BREUER, B.; BREUER, J.; ROHMERT, W.: Development of Warning Strategies and Driver-Vehicle Interfaces. Fifteenth International Technical Conference on the Enhanced Safety of Vehicles (ESV) Melbourne, Australia, May 13-17, 1996 Washington, D.C. (USA): Department of Transportation 1996

BARZ, M.; BIELACZEK, C.; BREUER, B.; BREUER, J.; ROHMERT, W.: Effects of Warning Strategies on Driver Behaviour and Strain. XXVI FISITA Congress "Engineering Challenge - Human Friendly Vehicles" 16.-23.6.1996 in Prag (CD ROM 1996)

BREUER, J.: Possibilities and Limitations of Assistance Systems for Car Drivers: Exemplary Results of Interdisciplinary Field Experiments. In: ÖZOK, A.; SALVENDY, G. (Hrsg.): Advances in Applied Ergonomics. Proceedings of the 1st International Conference on Applied Ergonomics (ICAE ´96) 21.-24.5.96 in Istanbul. Istanbul, West Lafayette: USA Publishing 1996

WEILACHER, V.; ANDREWS, M.; JACOBI, S.; BREUER, B.; BIELACZEK, C.; ROHMERT, W.; BREUER, J.: Evaluation Report Technical Annex 1: Evaluation of test data collected by the ROSES Test vehicle (RTV). Brussels: Commission of the European Communities - R&D programme Telematics Systems in the Area of Transport (DRIVE II V-2045): Deliverable No. 13 1996

BREUER, B.; BIELACZEK, C.; BARZ, M.; ROHMERT, W.; BREUER, J.; KRETSCHMER, B.: Evaluation Report Technical Annex 2: Driver behaviour and strain with warning strategies). Brussels: Commission of the European Communities - R&D programme Telematics Systems in the Area of Transport (DRIVE II V-2045): Deliverable No. 13 1996

BREUER, J.: Driver Behaviour and Strain in Critical Driving Situations. In: SEPPÄLÄ, P.; LUOPAJÄRVI, T.; NYGARD, C.-H.; MATTILA, M.: (Hrsg.): Proceedings of the 13th Triennial Congress of the International Ergonomics

Association Tampere, Finland. Finnish Institute of Occupational Health: Helsinki 1997

BREUER, J.: Analysis of Driver-Vehicle-Interactions in an Evasive Manoueuvre - Results of "Moose-Test" Studies. Sixteenth International Technical Conference on the Enhanced Safety of Vehicles (ESV) Windsor, Canada, June 01-04, 1998

Thomas Unselt

1996	Degree in mechanical engineering at Technical University of Darmstadt ("Diplom-Ingenieur")
1996-1999	Krupp Bilstein GmbH: technical specialist/key account managing for automotive shock absorbers and (air) suspension
Since 1999	DaimlerChrysler AG, Mercedes Car Group/Development, Dept. Active Safety (accident causation, driver behavior, assistance systems)

English Publications Addressing Active Safety Issues

UNSELT, T.; BEIER, G.: Safety Benefits of Advanced Brake Light Design. In: Gesellschaft für Arbeitswissenschaft (GfA), International Society for Occupational Ergonomics and Safety (ISOES), Federation of European Ergonomics Societies (FEES): International Ergonomics Conference. Munich, May 7th - 9th, 2003

AVAILABILITY OF NON-SCANNABLE ITEMS

NHTSA-03-14345 Item 3
Docket / Document Number

CD-ROM Submitted by Mercedes-Benz USA – Flashing Brake Lights (Exhibit C)

Name / Description of Item(s) non-scannable

MAY BE VIEWED IN

NHTSA's Technical Reference Office – Room 5111
Agency / Office Name / Room Number / Contact Person {if any)

during the hours of 9:30 am – 4:00 pm

(WP5.x;\ R:\nscanwp)